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11. (Amended) In a friction material having opposed surfaces with one surface engaging a movable, engageable part, the improvement comprising heat conducting elements disposed in said friction material in a selected arrangement and a varying concentration for transferring heat away from said engaging surface to a non-engaging surface.

Please add new claim 20 as follows:

20. The friction material according to claim 11, wherein said heat conducting elements comprise a greater density on said engaging surface than on said non-engaging surface.

Additionally, in accordance with 37 CFR 1.121(c)(1)(ii), all amended claims are set forth in marked up versions in the pages attached to this Amendment.

REMARKS

After carefully considering the Office Action mailed September 28, 2001, Claims 16-19 have been cancelled without prejudice. Claims 1, 3, 8 and 11 have been amended to more particularly define the present invention. Claim 20 has been newly added. Re-examination and reconsideration of the application, as amended, are requested.

The Examiner imposed a restriction requirement on the subject patent application stating that the invention of Group I, claims 1-15, is directed to a friction material. The Examiner then said the invention of Group II, claim 16-19, are drawn to a method for making a friction material classified in another class and subclass. The Examiner said the inventions are distinct for the reasons stated in the Office Action. The undersigned attorney on or about September 25, 2001, provisionally elected to prosecute with traverse the invention of Group I, claims 1-15. The undersigned attorney affirms this election in this Response to this Office Action. Claims 16-19 have been cancelled without prejudice.

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The Applicant respectfully submits that Claims 16-19 are drawn to making the friction material as claimed in claims 1-15 and the newly added claim 20. Accordingly, the Applicant respectfully submits that the inventions are not separate or distinct. The Applicant respectfully requests the Examiner to reconsider the restriction requirement after consideration of this Amendment.

The Examiner objected to the specification due to an informality in the disclosure on page 5, line 27. Appropriate correction has been made.

The Examiner rejected Claims 1-7, 9-15 under 35 U.S.C. §103(a) as being unpatentable over Shibata et al. (U.S. Patent No. 5,004,497) in view of Darfler (U.S. Patent No. 5,498,462). The Examiner contends that the Shibata et al. patent discloses a friction material for brake pads, clutch facing with improved wear resistance and thermal conductivity. The Examiner says that Shibata et al. fails to teach that heat conducting elements are positioned in a predetermined arrangement substantially normal to a friction engaging surface of the functionally graded material. The Examiner then looks to the Darfler patent as teaching that the effectiveness of heat transfer depends upon orientation of heat conducting elements. The Examiner contends that it would have been obvious to one of ordinary skill in the art at the time the invention was made to have arranged heat conducting elements of Shibata et al. in a predetermined orientation as taught by Darfler.

The Applicant respectfully traverses this rejection for the following reasons. Claim 1 has been amended to now specifically recite that the heat conducting elements are situated within the functionally graded material in an orientation and a varying concentration that transfer heat away from a first friction surface to a second non-engaging surface. Basis for these amendments is found in the subject patent application on page 5, lines 22-26, and on page 12, lines 1-6. Additionally, the Applicant notes that the term "functionally graded material" is defined on page 4, lines 22-26 in a particular manner. A functionally graded material is more than just simply a composite material as explained in the subject patent application as described in the Shibata et al. patent. Nowhere does the Shibata et al. patent teach or suggest a functionally graded material as claimed in the instant application. While the Examiner is correct that the Shibata et al.

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patent is directed to a friction material as is the instant invention, the subject invention advantageously employs a functionally graded material with heat conducting elements in an orientation and a varying concentration for transferring heat away from the first friction surface to a second non-engaging surface. Shibata et al. does not teach or suggest this feature. The Examiner looks to the Darfler patent as providing the teaching of unidirectional thermal conducting fibers. The Darfler patent does provide for unidirectional thermally conductive fibers, however, these fibers are in the form of a honeycomb. That arrangement is contrary to the instant invention. The Darfler patent merely teaches of providing thermally conductive fibers in a specific or distinct unidirection within a honeycomb arrangement. One of ordinary skill in the art would not look to using a honeycomb type structure as a friction material. Moreover, the fibers of Darfler are not in a varying concentration as in the instant invention. Consequently, the Applicant respectfully submits that one of ordinary skill in the art would not look to the Examiner's proposed combination absent the teachings of the instant invention.

The Examiner then rejected Claim 8 under 35 U.S.C. §103(a) as being unpatentable over the Shibata et al. patent (U.S. Patent No. 5,004,497) in view of the Miyamoto (U.S. Patent No. 6,001,440). The Examiner notes that Shibata et al. fails to teach a concentration of the heat conducting elements varying from a first surface to a second surface then looks to the Miyamoto patent as teaching of a varying concentration.

The Applicant respectfully traverses this rejection for the foregoing reasons as well as the following. Contrary to the claimed invention, the Miyamoto patent specifically relates to a heat conductive polyimide film used as a thermal fixation member in a laser printer. Miyamoto, in column 3, lines 30-35, discloses the film thickness as ranging from about 20 to 300 microns. Miyamoto teaches away from the use of his invention for thick film applications. Thus, the Applicant respectfully submits that the Miyamoto patent teaches away from the instant invention which is directed to a functionally graded friction material. Again, the Applicant respectfully submits that one of ordinary skill in this art would not look to combine the teachings of this patent with that of the Shibata et al. patent.

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When the subject matter of the invention as a whole is considered, it is respectfully submitted that the claims define an invention which is novel and unobvious over the cited references. Reconsideration of the objection and rejections are requested. Allowance of the claims at an early date is solicited.

Respectfully submitted,



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MARKED UP VERSION OF ALL AMENDED CLAIMS

1. (Amended) A friction material with improved wear resistance and thermal conductivity, comprising:
- a functionally graded material including a composite material having heat and wear resistant fibers therein impregnated with a resin; and
 - a plurality of heat conducting elements situated within said functionally graded material in an orientation and a varying concentration wherein said heat conducting elements transfer heat away from [one] a first friction surface of said functionally graded material to [another] a second non-engaging surface.
3. (Amended) A friction material as set forth in claim 1, wherein said plurality of heat conducting elements are positioned substantially normal to [a] said first friction surface of said functionally graded material.
8. (Amended) A friction material as set forth in claim 1, wherein said heat conducting elements comprise a [varying concentration from a] greater density on said first friction surface [to a] than said second non-engaging surface.
11. (Amended) In a friction material having opposed surfaces with one surface engaging a movable, engageable part, the improvement comprising heat conducting elements disposed in said friction material in a selected arrangement and a varying concentration for transferring heat away from said engaging surface to a non-engaging surface.

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MARKED UP VERSION OF ALL AMENDED SPECIFICATION PARAGRAPHS

Second full paragraph on Page 5:

Fig. 2 is a sectional view of a functionally graded friction material made with a plurality of fibers 10 and heat conducting elements 12 impregnated with a high temperature resin 16, like a phenolic resin, to form the composite 18. Composite 18 has first surface 20, also referred to as a friction surface or an engaging surface, and a second surface 22, also referred to as a non-engaging surface. The second surface 22 is typically joined to a support structure 24 (shown in dashed lines) like a metal backing plate by way of an adhesive, rivets or other fasteners, etc. The composite [16] 18 is formed from a plurality of strands 14 that are needle punched (also referred to as needling) into the mass of fibers 10. A base material like a felt material may be used, or the fibers 10 may have a sufficiently high density that eliminates any necessity of a base material.

TRANSMISSION

[X] facsimile transmitted to the Patent and Trademark Office (703) 872-9210

Date: NOVEMBER 28, 2001
SignatureMELISSA A. HENTHORN

(type or print name of person certifying)